TECHNOLOGY COMMERCIALIZATION

TEES TEXAS A&M ENGINEERING EXPERIMENT STATION

LAYER-BY-LAYER FILMS AND COATINGS CONTAINING MXENES

Lead Inventor

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Research Interests

- Polyelectrolytes
- Electroactive polymers
- Energy storage
- Anti-corrosion coating
- Dielectrics

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Overview

MXenes are two dimensional nanosheets containing transition metal carbides and/or nitrides having many desirable properties like graphene sheets. However, coatings that take advantage of MXenes and their properties have not yet been demonstrated. Flexible and wearable electronics require coatings with high electrical conductivity while performing under extreme mechanical bending and/or stretching conditions. The current inventive approach offers a new line of coatings based on MXenes especially for use with flexible electronics.

Technology

The layer-by-layer assembled composition consists of alternating layers of a cationic polymer layer and a negatively charged MXene layer. The LbL approach is versatile to a variety of surfaces, substrates, and geometries (Figure 1). For example, metal, glass, ITO-coated glass, plastic, gold-coated plastic, silicon wafer, and fabric are used as substrates, and many others are possible. The MXene-based layer-by-layer films or coatings exhibit enhanced properties, such as improved mechanical integrity, mechanical flexibility, enhanced electronic, and/or other useful features.

Advantages

- Mechanically flexible
- Electro conductive
- Electrochemically active
- Surface-agonistic coating technique
- Water-processable
- Cost-reduction for processing compared to graphene
- Accurate thickness control
- Patternable
- Transparent

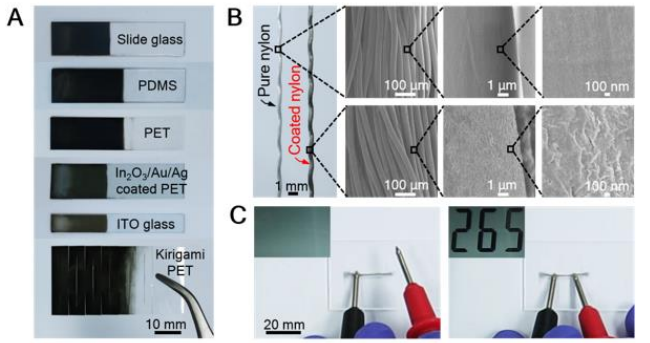

Figure 1. (A) Digital images of 40 layer pair coatings on various substrates. (B) Digital images and SEM images of pure nylon fiber and 20 layer pair coated nylon fiber. (C) Photographs to demonstrate conductive coating on nylon fiber (resistance = 26 MΩ).

Applications

- Flexible conductive substrates for flexible and wearable electronics
- Flexible electrodes for supercapacitors and batteries
- Barrier films
- Low-friction coatings
- Sensors

Stage of Development

Demonstrated LbL coatings on

- Glass, ITO-coated glass
- PET plastic
- In_2O_3/Au/Ag-coated PET plastic
- Polydimethylsiloxane (PDMS) and Nylon fibers

Conducted preliminary testing to show electronic conductivity.
Strain sensing and humidity sensing properties have been evaluated.

Patent Status

Patent Pending.